

## CLAIMS

What is claimed is:

1. A torque transfer coupling for use in a motor vehicle to transfer drive torque from a first rotary member to a second rotary member, comprising:
  - a transfer clutch operably disposed between the first and second rotary members;
  - a fluid flow circuit having a pressure chamber, a source of magnetorheological fluid, and a pump for pumping said magnetorheological fluid to said pressure chamber;
  - an actuator moveable in response to the fluid pressure in said pressure chamber to engage said transfer clutch;
  - an electromagnet operably disposed between said pressure chamber and said pump; and
  - a control system for controlling energization of said electromagnet for varying the viscosity of said magnetorheological fluid so as to vary the fluid pressure in said pressure chamber.

2. The torque transfer coupling of Claim 1 wherein said transfer clutch includes a multi-plate clutch pack operably disposed between the first and second rotary members, and a pressure plate that is axially moveable so as to exert a clutch engagement force on said clutch pack, and wherein said actuator is operable to control axial movement of said pressure plate as a function of the fluid pressure in said pressure chamber.

3. The torque transfer coupling of Claim 1 wherein said fluid flow circuit includes a flow passage between said pump and said pressure chamber, and wherein said electromagnet is selectively energized by said control system to regulate flow through said flow passage.

4. The torque transfer coupling of Claim 3 wherein said flow passage provides fluid communication between said pressure chamber and an inlet side of said pump.

5. The torque transfer coupling of Claim 1 wherein said pump is operable to pump magnetorheological fluid through said fluid flow circuit in response to a rotary speed difference between the first and second rotary members.

6 A transfer case comprising of:

first and second shafts;

a multi-plate clutch assembly having an input member and an output member, said input member driven by said first shaft and said output member coupled for driving said second shaft;

a torque transfer mechanism for controlling the magnitude of a clutch engagement force exerted on said multi-plate clutch assembly, said torque transfer mechanism including a piston slidably disposed within a piston chamber for selectively engaging said multi-plate clutch assembly, a pump for pumping magnetorheological fluid through said piston chamber, and an electromagnet operably disposed between said piston chamber and said pump; and

a control system for energizing said electromagnet to vary the viscosity of said magnetorheological fluid for causing a corresponding change in the fluid pressure within said piston chamber, wherein said fluid pressure in said piston chamber controls axial movement of said piston for varying said clutch engagement force exerted on said multi-plate clutch assembly.

7. The transfer case of Claim 6 wherein a rotational speed differential between said input member and said output member induces pumping action of said pump for pumping said magnetorheological fluid through said piston chamber.

8. The transfer case of Claim 6 further comprising a flow restrictor located downstream of said piston chamber for restricting flow of said magnetorheological fluid.

9. The transfer case of Claim 8 wherein said flow restrictor is disposed adjacent said electromagnet.

10. A motor vehicle, comprising:

a powertrain for generating drive torque;

a first driveline receiving drive torque from said powertrain;

a second driveline;

a torque transfer mechanism for selectively transferring drive torque from said first driveline to said second driveline, said torque transfer mechanism including an input member driven by said first driveline, an output member driving said second driveline, a transfer clutch operably disposed between said input and output members, a flow circuit having a pressure chamber, a source of magnetorheological fluid, and a pump for pumping said magnetorheological fluid to said pressure chamber, an actuator moveable in response to fluid pressure in said pressure chamber to engage said transfer clutch, and an electromagnet operably located in proximity to a flow passage between said pressure chamber and said pump; and

a control system for energizing said electromagnet to vary the viscosity of said magnetorheological fluid in said flow passage and cause a corresponding change in the fluid pressure within said pressure chamber.

11. The torque transfer coupling of Claim 10 wherein said transfer clutch includes a multi-plate clutch pack operably disposed between said input and output members, and a pressure plate that is axially moveable so as to control the magnitude of a clutch engagement force exerted on said clutch pack, and wherein said actuator is operable to control axial movement of said pressure plate as a function of the fluid pressure in said pressure chamber.

12. The torque transfer coupling of Claim 10 wherein said flow passage provides fluid communication between said pressure chamber and an inlet side of said pump.

13. The torque transfer coupling of Claim 10 wherein said pump is operable to pump magnetorheological fluid through said fluid flow circuit in response to a rotary speed difference between the input and output members.

14. A transfer mechanism for controlling the magnitude of a clutch engagement force exerted on a multi-plate clutch assembly that is operably disposed between an input member and an output member, comprising:

    a piston slidably disposed within a piston chamber and selectively engaging a clutch pack of the multi-plate clutch assembly;

    a pump in fluid communication with said piston chamber via a supply passage and a return passage, said pump operable for pumping a magnetorheological fluid through a flow path between said supply passage, said piston chamber and said return passage;

    an electromagnet disposed adjacent to a portion of said return passage; and

    a control system for energizing said electromagnet to vary the viscosity of said magnetorheological fluid and cause a corresponding change in fluid pressure within said piston chamber, thereby causing axial movement of said piston for engaging said clutch pack.

15. The transfer mechanism of Claim 14 further comprising a flow restrictor formed within said return passage for restricting the flow of magnetorheological fluid therethrough.

16. The transfer mechanism of Claim 15 wherein said flow restrictor is disposed adjacent said electromagnet.